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Monterey, California

THESIS

ESTIMATION OF THE LOCAL DELIVERY COSTS
AT NAVAL SUPPLY CENTER
SAN DIEGO, CALIFORNIA

by

William David Orr

June 1983

Thesis Advisor: Alan W. McMasters

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ESTIMATION OF THE LOCAL DELIVERY COSTS AT NAVAL SUPPLY CENTER SAN DIEGO, CALIFORNIA

by

illiam
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Submitted in partial fulfillment of the
requirements for the degree of

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ACRONYMS AND ABBREVIATIONS

CAC	Cost Account Code
CAL ICE	California Ice
CHL	Chilled Provisions
DODMDS	Department of Defense Material Distribution Study
DPSC	Defense Personnel Support Center
DTO	Direct Turnover
FFV	Fresh Fruits and Vegetables
FRZ	Frozen Provisions
GSK	General Stores Material
HIPRI	High Priority
LDIP	Local Delivery Individual Production Report
MHE	Material Handling Equipment
MILCON	Military Construction
MCRD	Marine Corps Recruit Depot
MTIS	Material Turned Into Store
MTR	Mandatory Turn-in Repairable
NAB	Naval Amphibious Base
NARF	Naval Air Rework Facility
NAS	Naval Air Station

NASM	Naval Air Station Miramar
NASNI	Naval Air Station North Island
NAVSTA	Naval Station
NAVSUP	Navy Supply Systems Command
NCA	National City Annex
NI	North Island
NISTARS	Navy Integrated Storage, Tracking, and Retrieval System
NRFI	Not-Ready-For-Issue
NRMC	Navy Regional Medical Center
NSC	Naval Supply Center
NSCSD	Naval Supply Center San Diego
NTC	Naval Training Center
O&MN	Operation and Maintenance, Navy
PWC	Public Works Center
PWCSD	Public Works Center San Diego
PWRS	Prepositioned War Reserve Stocks
SDT	Second Destination Transportation
SOAP	Supply Overhaul Assistance Program
TAC	Transportation Account Code
UMMIPS	Uniform Material Movement and Issue Priority System
32nd Street	Naval Station San Diego

I. INTRODUCTION

A. BACKGROUND

A continuing study of the local delivery system at NSC, Oakland and NSC, San Diego has been conducted since the Shore Establishment Realignment (SER) was implemented on 1 October 1980. SER consolidated the management of wholesale material located at industrial naval air stations to the control of nearby supply centers [Ref. 1]. In San Diego, the realignment involved the transfer of wholesale material located at the Naval Air Station (NAS), North Island to the custody of NSC, San Diego. In Oakland, NAS Alameda wholesale material custody was transferred to NSC, Oakland.

SER was developed in response to a DOD Material Distribution System (DODMDS) Study completed in 1978 [Ref. 2]. The purpose of this study was to examine the existing material distribution system and make recommendations for more effective and economical support services for both peace time and mobilization requirements. Consolidation of wholesale management under SER was expected to provide economies in personnel, equipment, and material assets through improved centralized management of critical assets within geographical areas.

Along with the task of transferring inventory accountability to NSC, San Diego, came the responsibility for the Naval Air Rework Facility (NARF) material distribution system. A pre-consolidation promise made to the industrial naval air stations was that there would not be any degradation of material support because of the consolidation of material inventories.

Eller and Moore conducted a pre-SER baseline analysis of the local delivery system at NSC, San Diego to serve as a basis for measuring future system performance and effectiveness [Ref. 3]. This study was followed with a more detailed study by Flchr which determined offload and onload times for unit pallet loads, driving times to each customer site, and the volume of material delivered. This analysis created a data base which could be used by a truck scheduling algorithm if such was deemed appropriate [Ref. 4]. However, prior to expending effort to develop such an algorithm, the current activities must be examined and made as efficient as possible. Only after this is done can a scheduling algorithm provide a payoff.

Before a manager can efficiently use his personnel and equipment assets within the local delivery system, he must know specific cost information. Then the volume of material that has to be moved and customer service standards can be weighed against the assets available and the costs incurred to operate the system so that a set of objectives and priorities can be established by management.

The management of costs within the NSCSD local delivery system is complicated by the two sources of funds used to operate the system. NSCSD pays for warehouse labor and drivers for non-commercial vehicles out of an operating budget from Operation & Maintenance, Navy (O&MN) funds. All equipment and transportation costs, which include Public Works Center (PWC) vehicle rentals and commercial trucks, are charged to the Navy Management Fund, Second Destination, Transportation Account Code (TAC) N036. This fund is managed by the Naval Supply Systems Command (NAVSUP). The use of this fund by NSCSD to hire commercial trucks was authorized by NAVSUP in 1979 [Ref. 5]. In contrast, NSC, Oakland hires both drivers and vehicles from PWC, San Francisco and pays for only warehouse labor from their O&MN operating budget.

The Navy Management Fund is a revolving fund that finances Navy transportation costs for material movement. Costs which are currently cleared through the NMF include Government Bills of Lading (GBLs) for other than household goods shipments, transportation contracts, and military transportation agencies. PWCSD, which is a Navy Industrial Fund (NIF) Activity, provides transportation services to NSCSD. All PWC transportation services purchased by NSCSD are reimbursed by the NMF back into the PWCSD NIF account. Commercial GBLs are billed directly to the NMF.

Transportation of Navy material is generally categorized by NAVSUP as either First or Second Destination. First Destination Transportation (FDT) is that transportation required to effect the delivery of material from a Navy industrial activity which fabricates new material or a procurement from a commercial source outside the Defense Supply System to the first point of use or storage for subsequent transfer within the Naval Supply System. Second Destination Transportation (SDT) is any transportation other than FDT. Under SDT funding, NSCSD is authorized to charge purchased services for the local delivery system to Transportation Account (TAC) N036 which identifies SDT costs used solely for NSCSD.

As a result, transportation services for the local delivery system are entirely funded by the NMF through GBLs and the PWCSD NIF. NSCSD does not pay for delivery vehicle services. The unconstrained use of Second Destination Transportation (SDT) to meet all transportation requirements has encouraged less than optimal efficiency within the delivery system.

B. PURPOSE

Presently, cost information is the missing link in the overall view of operating the local delivery system at San Diego. This report will attempt to ascertain those costs and establish a framework for providing a continuing stream of cost information for assessing the efficiency of the delivery system. A similar study of the local delivery system at the Naval Supply Center, Oakland was conducted by Allion and Tufts [Ref. 6].

C. METHODOLOGY

A review of pertinent documents was conducted prior to a field trip in order to gain a better perspective of the subject area. These documents included previous management reports and studies, and Navy Postgraduate theses. A field trip to NSC, San Diego was conducted to gain a first hand understanding of the local delivery system and the management tools being used to control the operation. Additionally, cost and labor information were gathered from public works, NSCSD, and government contract agreements.

Flohr's data base was used as the basis for a representative time standard for local delivery trips. Current cost data was applied to these standards in order to establish a cost per delivery trip. These costs also differentiated between Second Destination Transportation and NSCSD funding.

D. THESIS ORGANIZATION

Chapter One has discussed the subject matter and methodology of this thesis. Chapter Two will discuss changes in the NSC, San Diego local delivery system that have occurred since December, 1982. Chapter Three presents the cost data derived from the current local delivery system and analyzes

the application of the cost data to local delivery time standards. Chapter Four summarizes the findings of this thesis and makes recommendations for the incorporation of cost data analysis as a major tool for management control of the local delivery system.

II. NSC SAN DIEGO LOCAL DELIVERY SYSTEM

A. INTRODUCTION

As was mentioned earlier, the local delivery system at NSC, San Diego has been extensively described by Eller, Moore, and Flohr. The operation is managed within the Material Department (Code 300) and the Transportation Division (Code 303). Since December, 1982, there have been major changes in the physical layout of the distribution centers within NSCSD along with a change in policy concerning delivery schedules to local customers. These changes will be discussed in order to assess the impact they might have on deriving a cost model for the local delivery system.

B. MATERIAL DISTRIBUTION CONSOLIDATION

Figure 2.1 is a map of the Broadway Compound. A major change that occurred at the Broadway Compound in December, 1982 was the elimination of Building 11 as a consolidation point for local deliveries. Also, material packing and shipping operations have been discontinued at Building 11. Packing and shipping functions have been moved to the National City Annex (NCA) and general stores material (GSK) issued at the Broadway Compound are transported to NCA Building 70 with a round-robin shuttle of trucks and trailers. At NCA Building 70, all GSK and bulk materials are consolidated and staged for distribution to local customers. A receipt control unit is also located in Building 70 to process all customer direct turnover (DTO) receipts for consolidation and delivery without delay.

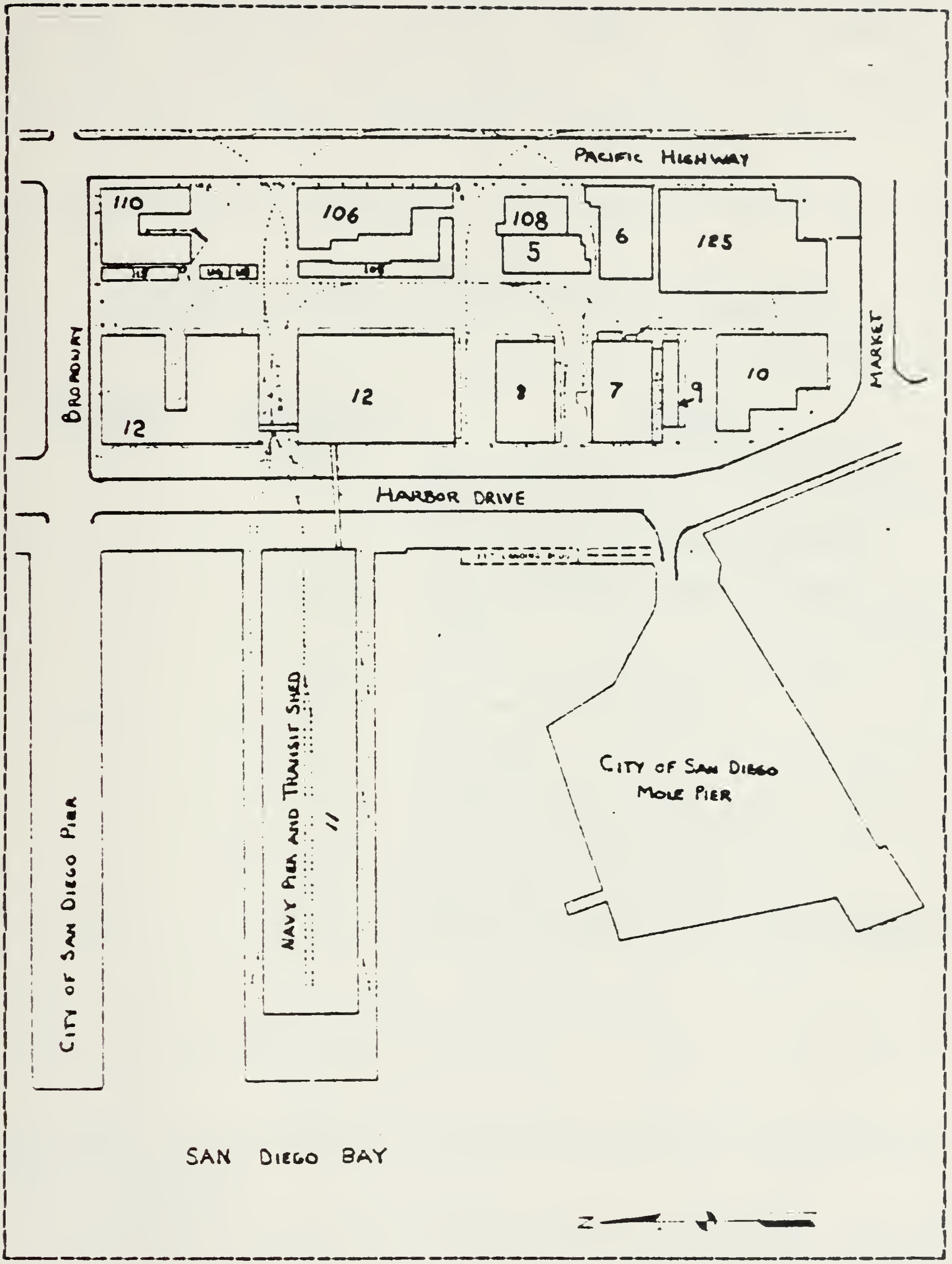


Figure 2.1 MAP OF BROADWAY COMPOUND.

The functions still performed at the Broadway Compound include: receiving, material storage, data processing, inventory control, administration, and local delivery dispatching. Table I details the amount of storage space available and the type of storage provided by each building in the compound.

TABLE I
CURRENT BROADWAY WAREHOUSE SPACE/UTILIZATION

BUILDING NUMBER	STORAGE AREA (sq ft)	MATERIAL STORED
1	37,288	Bulk storage of active items; pallet rack and bulk storage of inactive items; bin, modular bulk, pallet rack storage of medical supplies.
2	10,880	Bulk storage active items; bin and pallet storage inactive items.
7	13,178	Freeze and chill provisions
8	8,000	Flammable material
10	13,916	Cleaning supplies and hazardous material
11	13,440	Water cargo staging area; water cargo material storage.
12	103,126	Bin and modular pallet rack storage of active items.
125	15,322	Bulk and pallet rack storage of office supplies and misc. items.

In addition to the storage detailed in Table I, the first floor of Building 12 is used for centralized receiving and the staging operations within the compound. With the

exception of frozen and chilled provisions issued from Building 7, all warehouse material is staged outside, adjacent to its storage site. The material is then loaded onto the round-robin shuttles and transported to NCA for delivery, or packing and shipping. All perishable provisions are loaded directly for delivery from Building 7 or California Ice (CAL ICE).

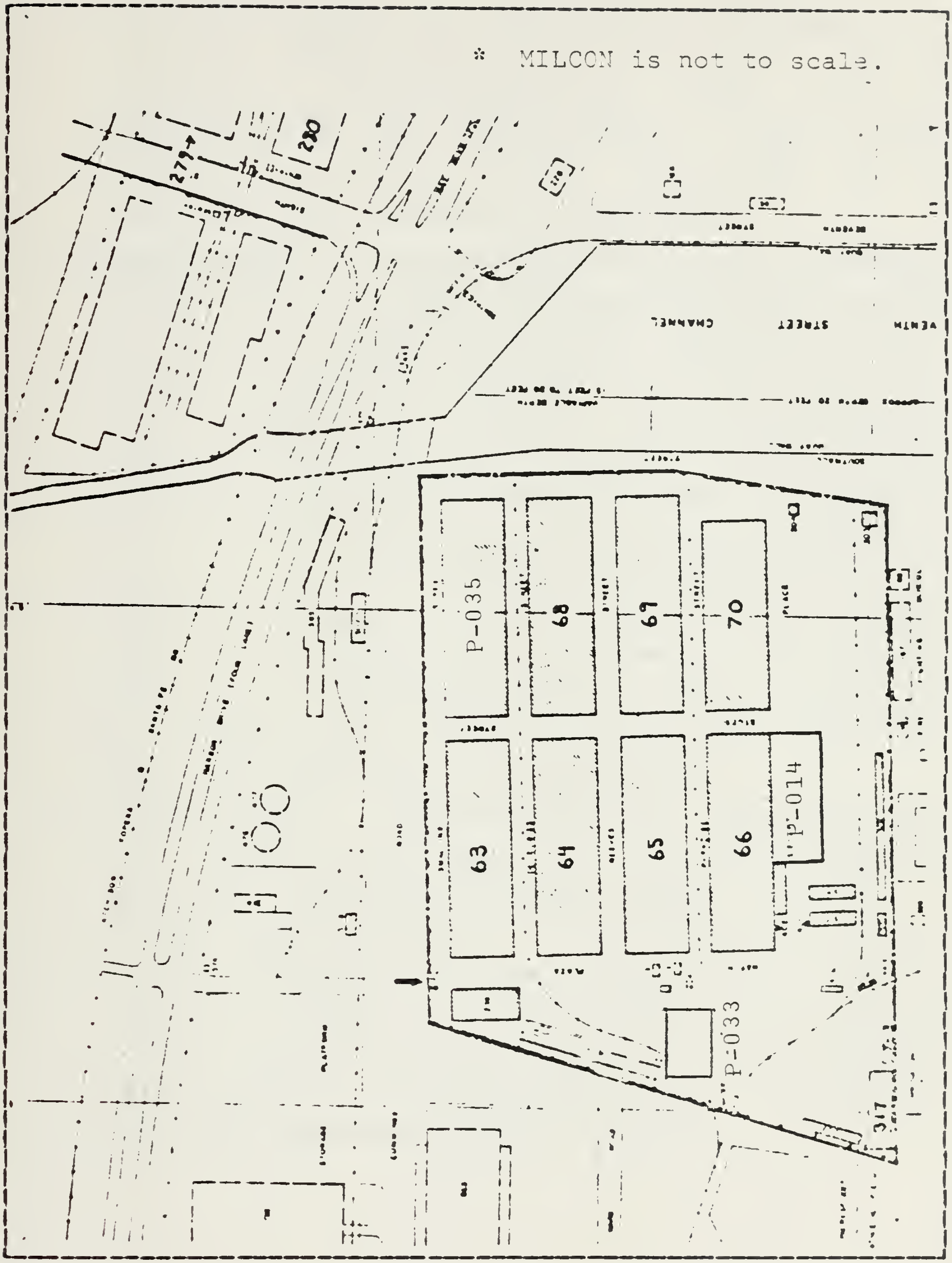
CAL ICE is a commercial firm located approximately one and a half miles southeast of the Broadway Compound. They have a contract to store fresh fruit and vegetables (FFV) that have been procured by the Defense Personnel Support Center (DPSC).

With the elimination of a consolidation point for material delivery at the Broadway Compound, Building 11, the NSCSD local delivery function operates as follows:

1. Broadway Compound: Dispatch point for all frozen and chill provisions. The local delivery dispatcher for the entire system is located here also.
2. California Ice: Dispatch point for FFV.
3. National City Annex: Dispatch point for all GSK, bulk, and dry provisions.

The changes in the local delivery system eliminated a second consolidation point at the Broadway Compound that had created two delivery systems. The decision to establish one consolidation point at NCA Building 70 is in anticipation of the completion of the major military construction work under way at NCA denoted as P-014, P-033, and P-035. Figure 2.2 and Table II show the present space utilization at NCA along with the areas of major construction. Eventually, all of the Broadway Compound administrative offices and warehouses will be relocated at the National City Annex. The Broadway Compound will then be turned over to the City of San Diego.

1. MILCON P-014: A supply storage high rise warehouse containing an automated storage and retrieval system



* MILCON is not to scale.

Figure 2.2 MAP OF THE NATIONAL CITY ANNEX.

has been designed for bulk material handling. It will add approximately 33,000 gross square feet to Building 66 and will accommodate 10,920 pallets of dry subsistence and clothing items. [Ref. 7] This building has recently become operational and is presently being loaded with inventories.

2. MILCON P-033: A supply storage high rise warehouse, equipped with the Navy Integrated Storage Tracking and Retrieval System (NISTARS), encloses approximately 180,000 gross square feet and will provide an automated receiving, storage, and retrieval system having a storage capacity for 85,000 binnable, 23,500 rackable, and 3500 non-rackable items. The current plan is to move all material now stocked in Buildings 1, 6, 11, and 12 at the Broadway Compound to the NCA NISTARS warehouse. [Ref. 7] This project has been expanded to include a delivery dock and consolidation warehouse to replace Building 70. This facility will be attached to the NISTARS warehouse (Building 3304) along the harbor side of the building.

3. MILCON P-035: It provides for the construction at the National City Annex of a hazardous/flammable materials warehouse of 32,000 square feet with a 25-foot stacking height. It is planned to relocate all such material warehoused in buildings 8, 10 (part will go to P-033), and 125 at the Broadway Compound to the new NCA building. [Ref. 7] Construction on this project has been completed and it is scheduled to become operational in June, 1983.

TABLE II

CURRENT NATIONAL CITY ANNEX SPACE/UTILIZATION

Building NUMBER	STORAGE AREA (sq ft)	MATERIAL STORED
63	26,843	Pallet rack and bulk storage of clothing and overflow non-perishable subsistence.
64	15,099	Metal items.
65	27,000	Staging area for outbound cargo NCA packing branch.
66	57,810	Dry provisions and bulk clothing.
68	27,456	Pallet rack and bulk storage of non-perishable subsistence.
69	26,496	Pallet rack and bulk storage of construction material.
70	27,000	Receiving and Local Delivery operation for NCA.
279	28,372	MTIS and SOAP material.
280	57,037	NRFI MTR's, wire cable and gases.
317	5,120	PWRS, pallet jacks and acid.
319	5,920	Packaged petroleum products.
322	44,026	RFI MTR's, clothing, classified equipment and publications, and photographic items.
NEW MILITARY CONSTRUCTION		
P-014	33,000	Dry provisions and bulk clothing.
P-033	180,000	Binnable and pallet rackable material (proposed).
P-035	32,000	Hazardous and Flammable material (proposed).

C. CUSTOMERS

NSCSD is the major Navy stock point for all of Southern California with a demand history file in excess of 350 local delivery customers [Ref. 3: P. 57]. Most of these activities are tenant activities or independent organizations supported within the confines of a larger military installation. Table III lists the major customer site areas serviced by the local delivery system. This breakdown of local delivery sites provides a workable number of routes that can serve as a basis for cost analysis and efficiency evaluation. Figure 2.3 shows the geographical location of these sites in relation to the Broadway Compound and the National City Annex.

It should be noted that for the purposes of this analysis, the North Island Annex and Long Beach Compound which are part of NSCSD are considered as local delivery customers. Each unit has its own extensive internal (on-base) local delivery system that operates separately from the Transportation Division (Code 303) at the NSC. The Point Loma Annex, which is also an NSCSD unit, is responsible for the distribution of bulk petroleum products and has little impact on the local delivery system.

D. MOTOR CARRIERS

The primary means of transporting material within the local delivery system is the motor carrier. The system of trucks and trailers as presented by Flohr is still intact with only minor changes [Ref. 4: P. 25]. In order to ensure adequate material movement, five commercial trucks have to be contracted for daily by the Transportation Division. Two of these trucks provide daily support to the local delivery system; the other three make daily runs to the Long Beach Annex with GSK, bulk, and dry provisions.

TABLE III

MAJOR CUSTOMER CONCENTRATIONS AND DISTANCES

CUSTOMER SITE	DISTANCE FROM (MILES)	
ACTIVITY	BROADWAY (PERISHABLE SUBSISTENCE)	NCA
NAVSTA Long Beach	112	116
Camp Pendleton	38	42
NAS Miramar	13	17
Point Loma	5	9
NTC San Diego	4	8
NRMC San Diego	2	6
NAS North Island	7	6
NAB Coronado	7	6
Imperial Beach	--	9
32nd Street	4	--

Frozen, chill, and FFV provisions are also being transported to Long Beach with vehicles rented from PWCSD. All other local delivery vehicles are also rented from PWCSD on a monthly basis. The drivers for all PWC vehicles are provided by NSCSD. Table IV summarizes the assets presently being used and the rental rate per asset [Ref. 8].

E. DELIVERY SCHEDULES

With the recent consolidation of GSK in NCA Building 70, NSCSD's local material delivery has evolved into more of a free flow system having much less emphasis on a formalized scheduling system. The existing zone delivery schedules have been substantially reduced from those reported by Eller and Moore. Table V lists the only delivery trips that adhere to a strict time schedule. In general, the policy for delivering material is to segregate all Issue Group (IG)

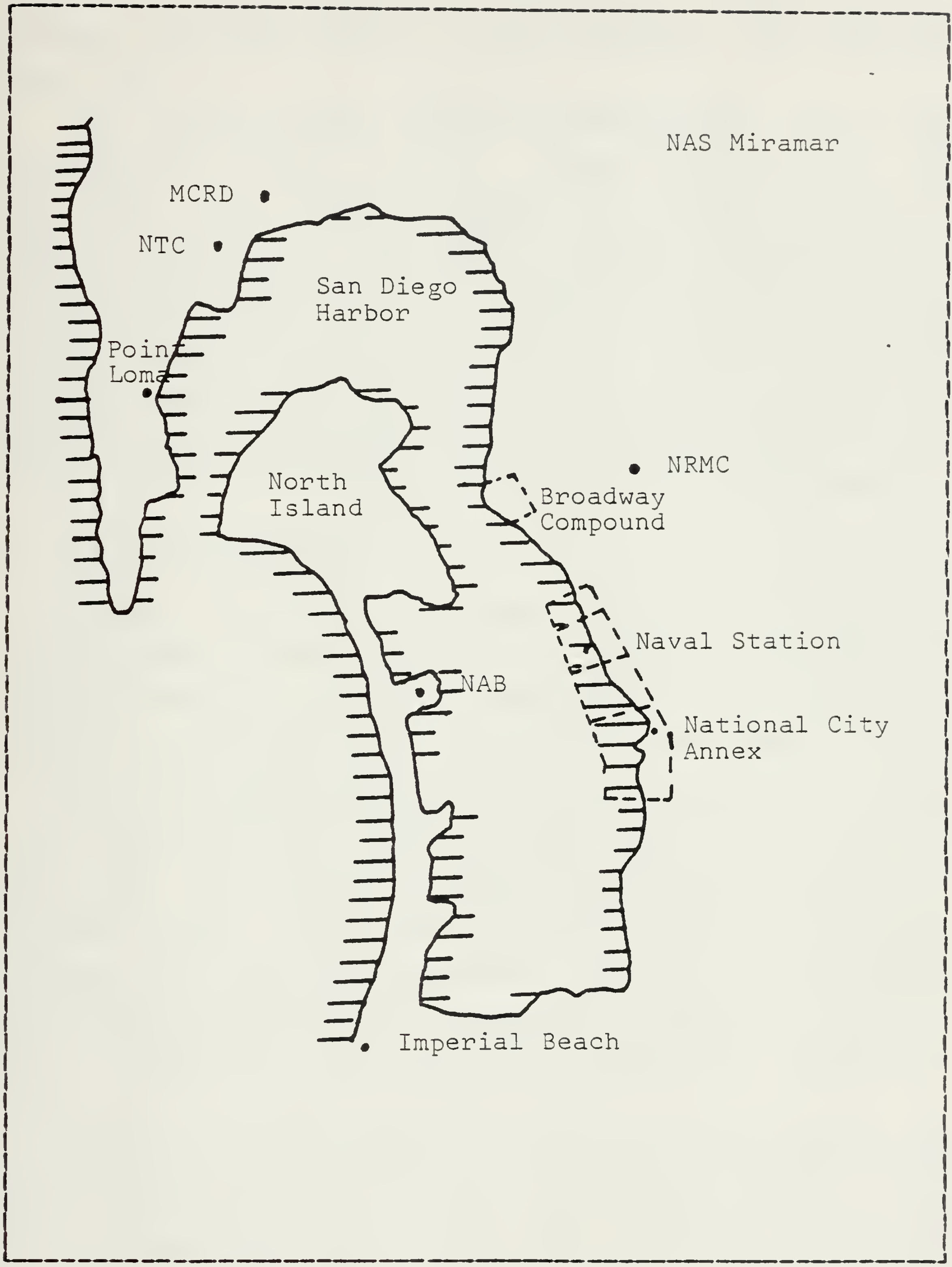


Figure 2.3 MAP OF NSCSD CUSTOMER LOCATIONS.

I material and to deliver it within the Uniform Material Movement and Issue Priority System (UMMIPS) time standards [Ref. 9].

The Transportation Division transportation hold time standards are one day for IG I, three days for IG II, and Seven days for IG III. However, an attempt is made to deliver material on a daily basis. Special consideration is given to the afloat and air station activities to ensure they receive daily service. This policy guarantees the best possible service to fleet activities. Often, the lower priority shipments to the smaller customers in the same geographic area are held for consolidation into one full truck load so that delivery assets can be fully utilized.

F. DELIVERY PROCEDURES

The NCA Building 70 warehouse morning shift comes to work at 0300. They pre-load the trucks for delivery and stage material for subsequent distribution later in the day. Normally, the morning shift supervisor dispatches the first loaded trucks when the drivers come to work at 0700.

The NCA Building 70 warehouse day shift comes to work at 1000. While the trucks are operating, they unload the shuttles from the Broadway Compound and load other local delivery trucks. After 1530, when the trucks have stopped running, the day shift processes the backlog of incoming material and segregates the material by customer so that it can be staged and pre-loaded for shipment by the morning shift.

The key to the elimination of a delivery backlog has been the split-shift work day for warehouse workers, from 0300-1130 and 1000-1830. The trucks deliver material to off-base customers only between 0700 and 1530. With this organization, the warehousemen are able to pre-load trucks

TABLE IV

LOCAL DELIVERY VEHICLES

VEHICLES RENTED FROM PWCSD
(FY 83 RATES)

TYPE	MONTHLY RATE $	MILEAGE RATE $	QTY
Truck, 1/2 ton pickup	194	.24	8
Truck, 5 ton Van	352	.40	1
Truck, 5 ton Refrig. Van	384	.40	1
Truck, 2 1/2 ton stake	352	---	1
Truck, 7 1/2 ton stake	384	.40	1
Tractor, 5 ton	384	.40	5
Tractor, 7 1/2 ton	432	.29	6
Tractor, 10 ton	432	.29	5
Van, 32 ft	110	---	1
Van, 40 ft	110	---	3
Van, 42 ft	110	---	2
Trailer, 40 ft Flatbed	110	---	22
Trailer, 35 ft Lowboy	110	---	1
Trailer, 55 ft Lowboy	110	---	1
VEHICLES OWNED BY NSCSD			
Truck, Straddle	---	---	8
COMMERCIAL VEHICLES ON CONTRACT			
Tractor, 7 1/2 ton, Trailer, 42 ft flatbed, and Driver	$ 295/unit/day		* 5

* Three commercial units make daily runs to Long Beach and two units augment the local area delivery system.

TABLE V

SCHEDULED, DEDICATED TRIPS

FREQ	TIME	DESTINATION	CARGO
Daily	0330	Long Beach	GSK
Daily	0400	Long Beach	GSK/Dry
Daily	1000	NI Quicktrans	HIPRI GSK
Daily	1300	NI Quicktrans	HIPRI GSK
Tues/ Thur	0400	Long Beach	FRZ/CHL

and, more importantly, they can stage material in advance for a rapid turnaround of trucks. Additionally, the day shift has time to work incoming material without continually loading trucks and the morning shift has time to properly pre-load and stage material before the trucks start running.

The commercial trucks used for moving material to the Long Beach Compound are loaded for the next day's trip when they return from their runs. The one truck which runs for the Shipping Division leaves daily at 0330. The remaining two trucks leave from NCA Building 70 between 0400 and 0500 daily. They return around 1130 and 1300 respectively.

After the first runs of loaded trucks have been dispatched by the morning supervisor, the dispatcher assumes dispatching duties. His control mechanism is the Daily Dispatch Record. This record is divided into three columns: red, green, and black. The red column records FFV movements; green records material relocation (deliveries); and black records internal movement within NSC. When the dispatcher assigns a driver and the number of pallets he is moving, the action is listed in the appropriate column of

the dispatch record. The driver acknowledges his assignment and job completion via radio communications with the dispatcher so that the dispatch record is continually updated.

The dispatcher determines his daily work load from several sources. Customer Service notifies the dispatcher at least one day in advance of all FFV, frozen, and chill deliveries scheduled. Building P-014 notifies the dispatcher at least one day in advance of all dry provision deliveries scheduled. Only GSK issues are not scheduled in advance. For this material, vehicles are dispatched based upon conversations with the Building 70 warehouse supervisor at the beginning of each day. Also, the dispatcher uses his location at the Broadway Compound to monitor internal movement requirements for the round-robin shuttle from the Broadway Compound to NCA Building 70.

Another factor in eliminating the backlog in Building 70 has been a new policy delivering fleet materials to the piers between 0300 and 0500 daily. Straddle trucks make these deliveries of non-perishable materials to the ships at the various piers when there is little other traffic congestion. Also, locked pallet cages are being used for items that might require safeguards from pilferage. This early morning delivery system frees the straddle trucks for urgent deliveries and on-base moves throughout the day. It also enables them to be more responsive to the fleet customers.

G. LOCAL DELIVERY MANAGEMENT TOOLS

The Transportation Division utilizes the Local Delivery Individual Production (LDIP) report to generate internal management data. Appendix A shows a sample form. This daily trip report is filled out by every driver and indicates key information such as transit time, onload time,

offload time, and the number of pallets moved. Each pallet is theoretically equal to forty cubic feet or one measurement ton and drivers are suppose to adjust their actual pallet counts to a standard pallet. This adjustment is considered necessary to account for the standard work unit used by NSCSD which is the measurement ton. This information is primarily intended for use in the NSCSD Uniform Management Report (UMR). [Ref. 4: P. 56]

Within the Transportation Division, LDIP data is tracked on a Wang minicomputer and a monthly status report is generated listing the measurement tons moved by Navy and commercial units in three categories: "to customer," "internal movement," and "Long Beach." Presently, the minicomputer is being programmed so that all LDIP data can be tracked.

As a LDIP data base is created, time standards for individual routes can be established, driver productivity can be evaluated, and truck utilization rates can be monitored. This data base would then be able to provide an update of Flohr's data for designing an automated vehicle delivery schedule if one is deemed necessary. Also, this data base could provide the basis for prorating cost data to delivery routes. This new program is scheduled to initially become operational in June, 1983 [Ref. 10].

Unfortunately, as a basis for managing the local delivery system, measurement tons are a poor way to measure work output. Pallets of material are what is moved, not measurement tons. These may be "full" or partially filled in the sense of a volume with the dimensions of 40x48x40 inches. With adjusted pallet counts, it is impossible to evaluate whether a delivery trip was made with a full load or how much exactly was carried. Actual pallet counts would not only provide better management information for the local delivery system, it would eliminate the subjectiveness and

errors that occur when drivers adjust their pallet counts for measurement tons. This adjustment is a compensation for pallets that are partially stacked. When the possibility of error is compounded daily by every driver in the system, the measurement ton data becomes very suspect.

III. ANALYSIS

A. INTRODUCTION

In this chapter, a determination of the costs incurred in operating the local delivery system will be made. These costs will be evaluated and matched against a set of time standards developed for each delivery route. These standards are representative figures that are derived from Flohr's data base. The standards are presented as a starting point for establishing a continuing management program to monitor local delivery costs.

Presently, local delivery costs are not being closely managed for several reasons. The costs of operating the system are spread between NSCSD funding for warehouse labor and vehicle drivers and Navy Management Funds for transportation and equipment costs. Accounting for these different costs within the delivery system is difficult. Meaningful work load production statistics and delivery route time standards have not been available so measuring costs accurately has been "too hard." Finally, there have been no real incentives for the Transportation Division to manage costs. Commercial vehicles are used to augment the local delivery system strictly on a "best judgement" basis. No other guidelines exist to measure how efficiently these assets are being utilized.

The delivery system at NSCSD is complicated. Straddle trucks are shuttling deliveries to the fleet activities at 32ND Street, while Public Works and commercial units are delivering to other local area customers. The third leg of the delivery system is the use of pickup and stake trucks to move Issue Group I, Quicktrans, and other hot items

throughout the day. As was discussed in Chapter Two, this system has evolved into a free flow operation designed to prevent a backlog of material at NCA Building 70 and to provide the best service possible to the customer.

Local delivery costs can be determined by matching incurred costs with delivery services rendered. If specific delivery routes existed with designated equipment and drivers, it would not be difficult to derive the related delivery costs. However, when assessing local delivery costs at NSCSD, there are few delivery routes of this type. How then can costs be distributed within the delivery system?

The common work unit within the system is the pallet data that is collected on all driver LDIPs. Each driver records the times and "pallets" (measurement tons) moved for each delivery trip. As noted in Chapter Two, this pallet data is recorded in the Transportation Division's minicomputer and printed monthly in the Work Load or Program Trends Report. This report could be the basis for prorating costs.

Table VI shows the distribution of the work load between Navy and commercial trucks for FY 1982. Unfortunately, this data does not distinguish between straddle truck and regular truck inputs [Ref. 11]. However, Eller's and Moore's research noted that 45% of the volume moved by NSCSD was delivered to fleet and shore activities located at 32nd Street from NCA Building 70 [Ref. 3: P. 107]. Almost all of this material is moved to its final destination on the base by straddle trucks.

B. COST DATA

The cost elements of the local delivery system include NSCSD personnel labor and overhead, Public Works vehicle rental costs, and commercial billings. The labor costs are

TABLE VI

LOCAL DELIVERY WORK LOAD SUMMARY

"PALLETS" DELIVERED "TO CUSTOMER"

FISCAL YEAR 1982

MONTH	TOTAL	NAVY	%	COM TRK	
OCT	19951	14459	72	5492	28
NOV	17929	12453	69	5476	31
DEC	19763	14321	72	5442	28
JAN	18561	13724	74	4837	26
FEB	17825	14258	80	3567	20
MAR	24499	18519	72	5980	28
APR	23064	17822	76	5242	24
MAY	17331	12289	71	5042	29
JUN	18533	12896	70	5637	30
JUL	21006	14757	70	6249	30
AUG	23242	15569	67	7673	33
SEP	20351	14621	72	5730	28
TOTAL	244214	175448		68766	
AVE	20351	14621	72	5730	28

incurred by WG-5 warehousemen, WG-7 straddle truck drivers, and WG-8 truck drivers who are all costed at an accelerated rate. Public Works vehicles are charged in accordance with Ref. 8. Commercial drayage is costed based on an established government contract rate.

1. LABOR COSTS

The NSCSD acceleration rate is the percentage of Federal contributions above a pay scale required to sustain an individual's fringe benefits and paid leave rights along with the employer's expenses such as training when the employee is not directly contributing to productivity. The NSCSD acceleration rate is 12% for fringe benefits and 18%

for leave and sick pay. For example, an employee who earns $10.00 per hour actually incurs a budgetary cost of $13.00 per hour. The employee's salary is $10.00 per hour but total expenses incurred by NSCSD total $13.00 per hour.

Labor hours are monitored with Labor Distribution Cards. These cards are filled out by designated supervisors and specify which job order numbers labor was applied against. These job order numbers are grouped into cost account codes (CAC) which serve as a major level of internal management control information. For Transportation, the two cost account codes that measure labor hours are internal movement (CAC 2193) and local delivery (CAC 2125). Based upon labor distribution cards, labor payroll statistics are incorporated with work units, man-hours expended, and production rates to provide a monthly Uniform Management Report (UMR).

For the month of July, 1982, the cost for labor under CAC 2125 was $39,425.19 for a total of 3,232 man-hours expended. This equates to an accelerated rate of $12.20 per man-hour expended by NSCSD to sustain the local delivery operation. For all of FY 82, the average labor cost per hour was $12.14 with a median of $12.18, and a standard deviation of $0.28.

The purpose of Labor Distribution Cards is to differentiate cost accounts for budget control information. However, a common criticism of UMR data is that the Labor Distribution Cards are filled out subjectively by designated supervisors and thus are of questionable quality. It is probably difficult for a supervisor to accurately charge the appropriate job order numbers all of the time. This would be especially true in the Transportation Division where internal movement jobs constantly interface with local delivery jobs. The supervisor may need to use his best judgement to allocate labor hours between the two cost

accounts. Fortunately, most workers work under one account for an entire day. In fact, most drivers specifically work only local delivery routes or internal movement on a given day. Only the warehousemen have occasion to work both cost account areas consistently by loading and offloading both delivery and shuttle trucks. While the UMR data is not completely accurate, it is the best assessment available and seems to be consistent on a month to month basis.

For the purposes of accounting for the total costs to NSCSD for operating the local delivery system, the UMR is the primary budget tool for managers. Although these costs are a major portion of the NSCSD budget, they represent only a segment of the total local delivery costs. Since all other costs for equipment and transportation are charged to SDT and are not controlled directly by NSCSD, an incentive factor is missing for the efficient management of these costs.

In order to better understand the application of SDT costs within the local delivery system, all NSCSD costs not directly associated with transportation costs should be excluded from this analysis. Only the NSCSD costs for WG-8 truck drivers are directly associated with transportation costs. Every rented PWC truck is driven by a NSCSD WG-8 employee. Since over 90% of NSC truck drivers are at the highest step of seniority, the WG-8, step 5 pay rate will be used for allocating labor costs in the local delivery system. That pay rate is $10.33 per hour plus a 30% acceleration rate of $3.10 per hour for a total of $13.43 per hour [Ref. 12].

2. VEHICLE COSTS

For Public Works vehicles, the rental costs include a rental fee, mileage, and unscheduled maintenance. The Transportation Division submits a monthly odometer reading

on each vehicle to Public Works and subsequently receives a billing based upon the monthly rental fee plus mileage and any unscheduled maintenance costs. The charge for trailers is a straight rental fee. Current Public Works rental and mileage rates are listed in Ref. 8. Table IV listed these rates for all Transportation Division assets.

The specific assets used for truck deliveries are the 7 1/2-ton and 10-ton tractors and trailers. The 7 1/2-ton tractors make most of the GSK/dry provisions deliveries and the 10-ton tractors are used for hauling perishable provisions to local customers and Long Beach. Both assets are rented at the same monthly and mileage rate, but since the 10-ton tractors are hauling provisions to Long Beach, they are incurring higher mileage costs. Table VII lists the tractors and average mileage costs per month. Additionally, mileage costs at one standard deviation above and below the average are listed to show the impact on mileage costs with mileage variations. The average mileage per month and standard deviation figures were computed using all of the data for all of the 7 1/2-ton tractors and three of the 10-ton tractors for the months February through April of 1983. The results demonstrate the relatively minor impact mileage variations have on the overall costs of renting transportation. As a result, only the average mileage figures will be used in this report to assess mileage costs for transportation within the local delivery system.

Commercial vehicles are rented at a flat rate of $295 per day for driver, tractor, and trailer. The $295.00 per day per unit is specified for an 8-hour day, 5-day week minimum, with no provision for overtime. An additional $10.00 per hour will be added above $295.00 per unit on Saturdays, Sundays, and Holidays. These units are directly controlled by the NSCSD dispatcher.

TABLE VII

MONTHLY TRACTOR MILEAGE COSTS

(costs @ $0.29 per mile)

TYPE EQUIP	ONE STD DEV BELOW MILES	($) COST	AVE MILES	($) COST	ONE STD DEV ABOVE MILES	($) COST
Tractor, 7 1/2-ton	525	152	755	219	985	285
Tractor, 10-ton	980	284	1250	363	1520	441

As was mentioned earlier, all vehicle rental expenses are charged to the Navy Management Fund, Second Destination Transportation Account Code N036. Straddle trucks and all other Material Handling Equipment (MHE) utilized in local delivery are owned by NSCSD and are a sunk cost to the operation. The drivers of Public Works vehicles, straddle trucks, and other MHE are employed and controlled by NSCSD; their salaries are paid from NSCSD O&MN operating funds.

3. COST DATA SUMMARY

Table VIII summarizes the costs that will be used to cost out local delivery trips. These figures represent the daily costs for labor and equipment and will be prorated to a per minute basis so that they can be applied to a basic time standard for each delivery route. Given that there are eight work-hours per day, the total costs in Table VIII will have to be divided by the rate of 480 minutes per day to get a cost per minute figure.

The truck costs are broken into two categories. Total costs include NSCSD labor costs for driving a PWC unit. SDT costs exclude the labor costs since thay are not charged to the NMF. All commercial drayage costs are charged to the NMF.

C. COST ANALYSIS

As discussed in the introduction to this chapter, the basis for prorating costs between Navy and commercial units should be the number of pallets moved by each group. The costs of Navy drivers and PWC vehicles compared with commercial units could be prorated based upon the work load distribution of pallets moved and applied to delivery route standard times. For the entire system, the breakdown of material moved "to customer" in July, 1982 was a 70/30 percentage split. The other raw data available concerning material movement was Eller's and Moore's finding that 45% of all material moved by NSCSD was delivered to 32nd Street activities by straddle trucks. This means that the 70/30 percentage split of work load is not really representative of the distribution between Navy and commercial trucks.

A review of Eller's and Moore's finding shows that their figures were based upon all customer deliveries and included Long Beach material. However, the Work Load Report category "to customer" does not include material delivered to Long Beach (it is tracked in another category). Since the work load breakdown excluded Long Beach deliveries, the Eller and Moore finding, adjusted to exclude the impact of material moved to Long Beach, resulted in the percentage of material moved to 32nd Street activities increasing to 50% of the total annual volume. Based upon this assumption, Table IX presents the actual work load distribution between Navy and commercial trucks.

TABLE VIII

DAILY DELIVERY TRUCK COSTS

TOTAL COSTS AND SDT COSTS

1. PWC unit: GSK/dry provisions	
* WG-8 driver, 8 hours	$107.44
7 1/2-ton tractor per day ($432/22)	19.64
Tractor mileage per day (34 mi @ $0.29)	9.95
Trailer per day	5.00
Total costs	$142.03
SDT Costs	$ 34.59
2. PWC unit: perishable provisions	
* WG-8 driver, 8 hours	$107.44
10-ton tractor per day ($432/22)	19.64
Tractor mileage per day (57mi @ $0.29)	16.53
Trailer per day	5.00
Compressor per day	41.60
Total costs	$190.21
SDT Costs	$ 82.77
3. Commercial truck One unit per day	$295.00

* Other than SDT cost. Labor is charged to the NSCSD O&MN operating budget.

Also included in this analysis is a comparison of the work load distribution derived from Flohr's data base after excluding Long Beach deliveries. This comparison was made

TABLE IX

WEIGHTED COST FACTORS BASED UPON WORKLOAD DISTRIBUTIONS

(measurement tons)

Work Load or Programs Trend Report:

NAVY	COMM.	TOTAL
70%	30%	%100

14,757 + 6,249 = 21,006

50% of Navy deliveries made by straddle truck:

.50(14,757) = 7378

Navy truck deliveries:

14,757 - 7378 = 7379

Revised Navy/commercial work load distribution:

NAVY	COMM.	TOTAL
54%	%46	100%

7,379 + 6,249 = 13,628

Flohr's data base:

NAVY	COMM.	TOTAL
55%	45%	100%

6,184 + 5,132 = 11,316

to verify the work load distribution derived from the Eller and Moore figures. Their study evaluated Fiscal Year 1980 statistics before SER was implemented. Flohr's data was derived from LDIPs collected in July, 1982. SER was implemented in October, 1980.

Flohr's data specifically measured the work load distribution between Navy and commercial trucks in conjunction with the process of establishing delivery route time stan-

dards and unit load statistics. This study provided work load totals without the impact of straddle truck deliveries.

The two values appear to substantiate each other and, for this report, prorated costs will be based upon a 55/45 percentage split of the work load between Navy and commercial trucks. Delivery costs for commercial deliveries to Long Beach and Navy deliveries of perishable subsistence will not be prorated since they handle all of the work load in these particuliar areas.

Table X shows the standard and prorated costs that will be used in calculating delivery trip costs. Although 50% volume to 32nd Street derived from Eller and Moore appears to be a valid figure according to personnel in Transportation, it is only an estimate. Better information on the value of this percentage is expected when the new program for the Transportation minicomputer comes on line. All truck driver trip logs will be recorded to measure individual productivity, establish time standards for individual routes, and accumulate aggregate work load productivity figures that can accurately determine the pallet distribution for prorating costs in the delivery system.

D. TIME STANDARDS

Time standards can be used as a basis for allocating prorated costs. These costs can be applied at a cost per minute rate and an overall cost per delivery trip can be calculated. This premise is set forth as a basic mechanism that can easily be applied to an updated time standard when the new minicomputer program becomes operational. For this report, Flchr's data base of LDIPs for July, 1982 was used to establish a representative time standard against which current costs could be applied.

TABLE X

STANDARD AND PRORATED COSTS FOR LOCAL DELIVERIES

1. Navy GSK/dry provision deliveries:		
	Total Costs	$142.03/day .30/min
	SDT Costs	$ 34.59/day .07/min
2. Prorated GSK/dry provision deliveries:		
Total	.55($142.03) + .45($295.00) =	$210.87/day .44/min
SDT	.55($ 34.59) + .45($295.00) =	$151.77/day .32/min
3. Navy Perishable provisions:		
	Total Costs	$190.21/day .40/min
	SDT Costs	$ 82.77/day .17/min
4. Commercial Deliveries to Long Beach:		
	SDT Costs	$295.00/day .61/min

The first step in the data sort was to eliminate all GSK delivery data originating from the Broadway Compound. Since these deliveries are now consolidated at NCA, they would not match the GSK time standards calculated for NCA deliveries.

The July data was then segregated into GSK/dry provision deliveries and perishable subsistence deliveries. From these two categories, the data was sorted into groups by local customer sites. This sort of the data base served two purposes. First, perishable deliveries are being costed at a different rate than GSK/dry provision deliveries. Secondly, all perishable deliveries originate from the Broadway Compound or CAL ICE while all other deliveries

originate from NCA. Therefore the different types of deliveries should have different time standards.

The data was then analyzed by customer site and delivery type. Since the data often consisted of multiple stops for one trip, the data had to be reviewed manually to ascertain the number of trips made and which data entries listed the transit times to the actual site. These transit times were averaged to find the transit time standard to each site. After this review, the data was processed to find the total pallet offload times, offload delay times, and local transit time between stops at the customer site. These total time values were divided by the number of trips to the site in order to establish an average time per trip for all phases of the delivery trip.

Table XI lists all of these time standards. Since eliminating all of the Broadway Compound GSK delivery data would not show the full impact of the trips required to move material within the delivery system, the total number of delivery trips to each customer site in July was included under trips per month. This presentation of the data should then provide an overview of the delivery system that reflects the correct amount of business and is based upon an accurate time standard for deliveries originating from NCA.

E. LOCAL DELIVERY TRIP COSTS

Utilizing the cost values in Table X and the time standards set forth in Table XI, Table XII lists the overall cost per delivery trip. Additionally, Table XIII lists cost per trip figures rated against miles. Both of these tables present cost data based on a Navy cost, a prorated cost, and a commercial cost whenever both type of assets are being used for the route. Also, these costs represent only SDT costs to the system. The values in Table X could also be

TABLE XI

LOCAL DELIVERY TRIP TIME STANDARDS

(in minutes)

1. From Broadway Compound:

ACTIVITY	TRIPS per month	--TRANSIT-- to area	local	DELAY wait for offload	OFFLOAD
Camp Pendleton	2	60	--	15	15
NASM	4	30	4	6	18
NRMC	2	20	--	20	5
Long Beach	9	153	35	49	50
Point Loma	14	24	8	28	48
NTC/MCRD	--	--	--	--	--
Imperial Beach	--	--	--	--	--
NAB Coronado	5	28	3	19	20
NASNI	7	20	--	23	36
32nd Street	31	15	9	26	38
2. From National City Annex:					
Camp Pendleton	12	64	--	20	28
NASM	16	35	6	19	37
NRMC	10	18	--	5	23
Long Beach *	60	--	--	--	--
Point Loma	24	30	5	28	39
NTC/MCRD	34	25	--	19	25
Imperial Beach	14	25	--	13	34
NAB Coronado	20	30	4	16	22
NASNI	72	23	5	17	28

* Long Beach commercial delivery units are paid $295 a day and normally take 8 hours to complete a trip. There are no provisions for overtime or credit on the daily fee if the unit takes more or less than 8 hours to complete the trip.

used to calculate the total cost per trip. For example, the time standard for perishable deliveries to Point Loma is 128 minutes. At the SDT rate of $0.17 per minute, the trip cost equals $21.76. Using the total cost rate of $0.40 per minute, the trip cost equals $51.20. This table presents SDT costs within the local delivery system. However, a manager could use any set of values from Table X depending upon the information he needs to know. Total costs for Navy units could be rated against commercial costs so that labor costs are taken into consideration with both types of assets. In this study, SDT costs have been recorded since these costs are charged to the Navy Management Fund. In reality, a manager need to look at transportation costs from both perspectives.

TABLE XII

LOCAL DELIVERY SDT COST PER TRIP

ACTIVITY	TOT. TIME (min)	NAVY ($)	PRO-RATED ($)	COM TRK ($)
1. From Broadway Compound (perishables):				
Camp Pendleton	150	25.50		
NASM	88	14.96		
NRMC	65	11.05		
Long Beach	440	74.80		
Point Loma	128	21.76		
NAB Coronado	98	16.66		
NASNI	99	16.83		
32nd Street	103	17.51		
2. From National City Annex (GSK/dry):				
Camp Pendleton	176	12.32	56.32	107.36
NASM	132	9.24	42.24	80.52
NRMC	64	4.48	20.48	39.04
Long Beach				295.00
Point Loma	132	9.24	42.24	80.52
NTC/MCRD	94	6.58	30.08	57.37
Imperial Beach	97	6.79	31.04	59.17
NAB Coronado	102	7.14	32.64	62.22
NASNI	93	6.51	29.76	56.73

TABLE XIII
LOCAL DELIVERY SDT COST PER MILE

1. From Broadway Compound (perishables):

ACTIVITY	TOT. MILES	NAVY ($)	PRO RATED ($)	COM TRK ($)
Camp Pendleton	76	0.34		
NASM	26	0.58		
NRMC	8	1.38		
Long Beach	224	0.33		
Point Loma	10	2.18		
NAB Coronado	14	1.19		
NASNI	14	1.20		
32nd Street	8	2.19		

2. From National City Annex (GSK/dry):

Camp Pendleton	84	0.15	0.67	1.28
NASM	34	0.27	1.24	2.37
NRMC	12	0.37	1.71	3.25
Long Beach	116			1.27
Point Loma	18	0.51	1.03	4.47
NTC/MCRD	16	0.41	1.88	3.59
Imperial Beach	18	0.38	1.72	3.29
NAB Coronado	12	0.60	2.72	5.19
NASNI	12	0.54	2.48	4.73

IV. FINDINGS AND RECOMMENDATIONS

A. FINDINGS

The local delivery system at NSCSD appears to emphasize effectiveness rather than efficiency. The bottom line seems to be to provide quality service with a minimal amount of delays in getting material to the customer. Such good customer service may be ignoring the issue of efficient resource utilization. For example, since 1979 NSCSD has been augmenting local delivery assets with commercial units on an "as required" basis. Without any restraints on SDT funding, the use of commercial units has grown to a regular demand of five units daily and as many as nine units when Navy drivers are absent or work loads increase [Ref. 10].

How does the Transportation Division assess how well these assets are being used? LDIP data is being filled out by the drivers, but only total measurement tons are being recorded for the monthly Work Load or Program Trends Report. Also, UMMIPS data is being collected on transportation hold times. However, UMMIPS data does not provide any information about how efficiently assets are being utilized. Only the management objective of full loads and a qualitative assessment by top line supervisors can evaluate whether trucks are fully loaded for local delivery trips. This is a major roadblock in trying to evaluate the efficiency of the NSCSD local delivery system. As a consequence, a question that cannot be accurately answered is whether the average trip costs are based upon fully loaded trailers or some lesser level of loading.

Apparently the advantage of using a standard measurement ton work unit is that it can provide a basis for comparing productivity between different divisions at NSCSD. For the Transportation Division, the use of the standard work unit to measure productivity should be reconsidered. The advantages of actual pallet counts for measuring both the effectiveness and efficiency of the delivery system appear to outweigh the advantages of a standard work unit just for the sake of uniformity.

A major consequence of the local delivery system's emphasis on effectiveness is the excessive unloading delay times experienced by the drivers when they arrive at their destinations. A review of Table XI shows that the delay time on each delivery route ranges from 18% to 30% of the total time for each trip. These high figures are not totally surprising considering that unscheduled delivery trips probably arrive unexpectedly and thus would not give the customer any time to prepare for delivery and unloading of the material.

Another consideration is the undesirable effect unscheduled deliveries appear to have on unloading times. Given a situation where a customer site creates delay time while scrambling around to unload the delivery truck, it appears to then follow that a less than optimal force of labor and equipment completes the unloading task.

This "compounding" of delays is an interesting phenomenon. The Transportation Division strongly supports unscheduled deliveries as the best way to provide the customer timely service. The Transportation Division's contention is that most customer sites have receiving units and that therefore delay times at these sites are minimal. When there has been a problem at a particuliar site, personal communications have resolved the issue. These claims of minimal delay times are not substantiated by the

time standards derived from July 1982 LDIPs. Since December 1982, delivery schedules have become even less structured. Although the impact of this relation on subsequent unloading delay times has not been measured, it is difficult to believe that delay times have not increased even more. It will be interesting to see whether the new minicomputer data collection program substantiates the claim of minimal delay times or supports the conclusion that unscheduled deliveries cause large delay and unloading delay times.

Tables X, XI, and XII can be used to demonstrate the impact of delay times on delivery trip costs. By subtracting the delay times from the total times for each delivery route, significant cost savings per trip can be realized. For example, Table XI shows an average delay time of 28 minutes for perishable deliveries to Point Loma. Table XII shows a standard of 128 minutes and $21.76 per trip at $0.17 per minute (from Table X). Subtracting the delay time of 28 minutes from the trip time standard of 128 minutes results in a new standard of 100 minutes and $17.00 per trip. This change creates a cost savings of $4.76 per trip.

A cost per mile figure is often used to emphasize delivery costs, but this figure can also reflect excessive delay times. Using the same example of perishable deliveries to Point Loma, the $2.18 cost per mile listed in Table XIII is calculated by dividing the trip cost, $21.76, by total trip distance, 10 miles. With the revised trip cost of $17.00, the cost per mile figure is $1.70. This represents a savings of $0.48 per mile. Even if all delay times cannot be eliminated, any reduction will be reflected in substantial cost savings because of the number of trips made monthly. These delays stand out as a prime area for improvement and increased efficiency.

The Transportation Division is being evaluated on its backlog in NCA Building 70 and the UMMIPS timeframes. They are not being evaluated on asset utilization. With this perspective, the incentive is strong for the manager is to advocate a free flow delivery system and to ensure he is not too conservative when scheduling commercial units to augment his work force. Certainly there is no penalty if all deliveries are made in less than UMMIPS standards; the customer has received exceptional service and the local delivery system has exceeded its performance standards. This is a logical policy to follow as long as there is no constraint on SDT funding.

At present rates, it costs twice as much to operate a commercial unit as it does to operate a Navy unit delivering GSK/dry provisions (see Table X). Depending upon the work load distribution, the prorated costs of operating the system can vary significantly as illustrated in the range of costs listed in Table X. Since ceiling points for NSCSD employees are constrained, commercial units do have to be hired in order to meet all delivery requirements. More government drivers would reduce overall expenses, but the reality of personnel constraints dictates that management concentrate instead on minimizing commercial units and change the prorated cost structures. Since April 1980, commercial units have been hired on a daily basis. This policy sgnificantly decreased the administrative burden of auditing trip sheets, balancing and certifying each bill, and forwarding the carrier's bill for payment. Now the Center counts "truck days" used in the week and prepares one GBL for the whole week. However, a GBL for the total "truck days" does not ensure that trucks are always being utilized in the most cost effective manner. The requirements for commercial units should be documented carefully so that a much lower price could be beneficially negotiated on a route

basis as is being done in Norfolk with "Guaranteed Traffic Service."

The future does not indicate an increasing role for commercial units at San Diego. With the completion of military construction (MILCON) P-033, all warehouse storage will be consolidated at the National City Annex. When this happens, the round-robbin shuttle of materials will no longer occur and those assets can be utilized in the local delivery system instead of the Broadway to NCA movement. This project will incorporate the Navy Integrated Storage, Tracking and Retrieval System (NISTARS) and the Navy Automated Transportation Documentation System (NAVADS). These systems should provide a vastly improved information base for predicting work loads and asset requirements for the local delivery system. Combined with the Transportation Division's internal management information, these information sources should provide a basis for an improved resource management system that could produce both effective and efficient customer service.

B. RECOMMENDATIONS

This analysis has described the basic cost and time characteristics of NSC, San Diego's local delivery system with the objective of generating a renewed interest in the efficient use of transportation assets and SDT funds. Specific recommendations for improving the use of these resources follow.

NISTARS, NAVADS, and internal programs will provide a wealth of information that will facilitate improved resource management for the local delivery system. However, even before this information is obtained, significant improvements in resource management can be realized by first tightening up the existing system through the elimination of

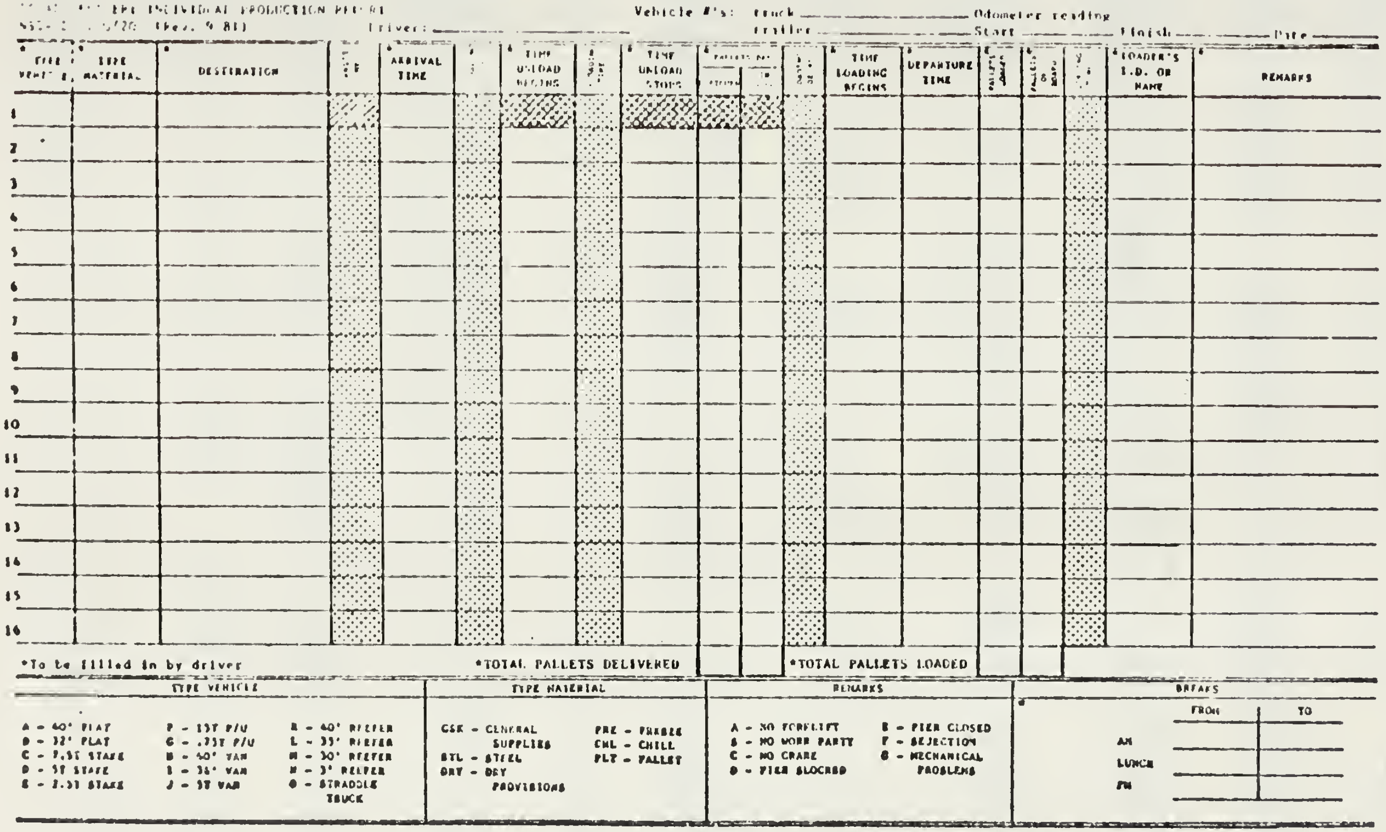
inefficiencies such as the delays at a customer site. A second step is to consider replacing the existing commercial contracts with "Guaranteed Traffic Service" route contracts. Finally, if further improvements are still appropriate, a vehicle scheduling algorithm should be considered.

An abundance of information about measurement tons does not really tell a manager whether transportation assets are properly utilized. Also, adjusted pallet counts cannot be used in formulating a truck scheduling algorithm. Whether or not a pallet is fully stacked does not change the fact that a trailer has a specified capacity of pallets that can be loaded. These trailer capacities and actual loading records are the key to a meaningful data base. Actual pallet counts should be adopted as the standard work unit within the local delivery system.

Customer Service, UMMIPS timeframes, and material backlogs are still the primary measurements of effectiveness in the local delivery system. The cost measurements and data from this thesis should provide a means for counter balancing these effectiveness measures with measures of efficiency. The cost information in this thesis gives a different perspective to the delivery system management and should provide insights as to where management efforts could create significant cost savings without impacting on the effectiveness of the local delivery system. It should also be realized that any cost savings that could result from recommended improvements would reduce the amount of SDT funds needed to operate the delivery system. Unfortunately, there is no incentive at present to manage these funds carefully. As a result, there is no motivation to make improvements. The delivery system is already meeting UMMIPS time standards and further changes that do not reduce transportation hold times will not be a high priority issue unless management's perspective of the delivery system is changed. An awareness of SDT costs needs to be emphasized.

APPENDIX A

LOCAL DELIVERY INDIVIDUAL PRODUCTION REPORT



[illegible] INDIVIDUAL PRODUCTION REPORT
NSC-[illegible] (Rev. 9 81)
Driver: ____
Vehicle #'s: truck ____ Odometer reading
trailer ____ Start ____ Finish ____ Date ____

	*TYPE VEHICLE	*TYPE MATERIAL	*DESTINATION	[illegible]	*ARRIVAL TIME	[illegible]	*TIME UNLOAD BEGINS	[illegible]	*TIME UNLOAD STOPS	*PALLETS [illegible]		[illegible]	*TIME LOADING BEGINS	*DEPARTURE TIME	*PALLETS [illegible]	*PALLETS [illegible]	[illegible]	*LOADER'S I.D. OR NAME	*REMARKS
										[illegible]	[illegible]								
1																			
2																			
3																			
4																			
5																			
6																			
7																			
8																			
9																			
10																			
11																			
12																			
13																			
14																			
15																			
16																			
*To be filled in by driver							*TOTAL PALLETS DELIVERED					*TOTAL PALLETS LOADED							

TYPE VEHICLE

A - 40' FLAT	F - 15T P/U	K - 40' REEFER
B - 32' FLAT	G - .75T P/U	L - 35' REEFER
C - 7.5T STAKE	H - 40' VAN	M - 30' REEFER
D - 5T STAKE	I - 35' VAN	N - 3' REEFER
E - 2.5T STAKE	J - 5T VAN	O - STRADDLE TRUCK

TYPE MATERIAL

GSK - GENERAL SUPPLIES	FRZ - FREEZE
STL - STEEL	CHL - CHILL
DRY - DRY PROVISIONS	PLT - PALLET

REMARKS

A - NO FORKLIFT	E - PIER CLOSED
B - NO WORK PARTY	F - REJECTION
C - NO CRANE	G - MECHANICAL PROBLEMS
D - PIER BLOCKED	

BREAKS *

	FROM	TO
AM		
LUNCH		
PM		

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